

## THREE NEW SPECIES OF THE STINGRAY GENUS *UROTRYGON* (MYLIOBATIFORMES: UROLOPHIDAE) FROM THE EASTERN PACIFIC

*Tsutomu Miyake and John D. McEachran*

### ABSTRACT

Three new species of the stingray genus *Urotrygon* are described from the topical eastern Pacific. *Urotrygon nana* occurs from the west coast of Mexico and Costa Rica and is distinguished by its small eyes, dense covering of denticles on snout and margin of the disc and small size at maturity. *U. reticulata* occurs off the Pacific coast of Panama and is distinguished by its fine tan to brownish vermiculations. *U. simulatrix* occurs off the Pacific coast of Panama and is distinguished by its stout cone-shaped and slightly recurved denticles covering the dorsal surface and broad yellowish-white border along the dorsal disc and pelvic fins.

In a recent study based on morphometry, meristic characters and squamation, Miyake and McEachran (1986) suggested that *Urotrygon* is composed of seven nominal species and three undescribed species. We herein describe the three new species and present a key to the species of *Urotrygon*.

### METHODS AND MATERIALS

Specimens examined were obtained from the following institutions: California Academy of Sciences, San Francisco (CAS and CAS-SU); Field Museum of Natural History, Chicago (FMNH); Gulf Coast Research Laboratory Museum, Ocean Springs (GCRL); Los Angeles County Museum of Natural History, Los Angeles (LACM); Scripps Institution of Oceanography, La Jolla (SIO); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). Thirty morphometric measurements were made following Bigelow and Schroeder (1953), Dixon (1969) and Miyake and McEachran (1986). Number of vertebral centra from synarcuum to origin of tail spine were counted from radiographs. Counts of tooth rows on upper jaw follow Hubbs and Ishiyama (1968). Measurements of angle of snout follow McEachran and Compagno (1979). Descriptions of denticles and thorns are based on comparable stages of development. The terminology of denticles and thorns follows Reif (1979). Thorns are defined as only those on the midline of dorsal disc and tail.

### *Urotrygon nana* new species Figures 1A and 2A, Table 1

*Urotrygon nebulosus*; Castro Aguirre, 1965: 230-231 (not *Urolophus nebulosus* Garman, 1885).  
*Urotrygon* sp. (1); Miyake and McEachran, 1986: 291-302.

*Holotype*.—FMNH 97107, male, 148 mm TL, Chiapas, Mexico, 14-18 Dec. 1954, collected by L. P. Wood et al.

*Paratypes*.—FMNH 97108, 4 females, 113-167 mm TL, Chiapas, Mexico, 14-18 Dec. 1954, collected by L. P. Wood et al.; SIO 65-167, 28 males, 82-169 mm TL, 13 females, 67-161 mm TL, Golfo de Tehuantepec, Mexico, 7 June 1965.

*Other Material Examined*.—CAS 4734, 1 male (193 mm TL), 22°44'N, 105°39'W, Nayarit, Mexico, 29 July 1932; CAS-SU 46731, 1 male (150 mm TL), 14°13'N, 92°02'W, west of Champerico, Guatemala, 15 Dec. 1937; FMNH 72281, 2 females (150 and 181 mm TL), Chiapas, Mexico, 14-18 Dec. 1954, collected by L. P. Wood et al.; LACM 30745-11, 1 male (202 mm TL), 3 females (207-243 mm TL), Alrededor Isla de Chira, Golfo de Nicoya, Costa Rica, 27 Nov. 1968, collected by P. Leon; LACM 33806-97, 1 male (194 mm TL), Boca Burranca, Puntarenas, Costa Rica, 12 June 1973.

*Diagnosis*.—Eyes small, diameter 1.88 to 3.76% of distance from snout to cloaca. Disc width 54.70 to 67.90% of total length. Length of dorsal lobe of caudal fin 12.44 to 19.93% of total length. Small denticles densely covering snout and ex-

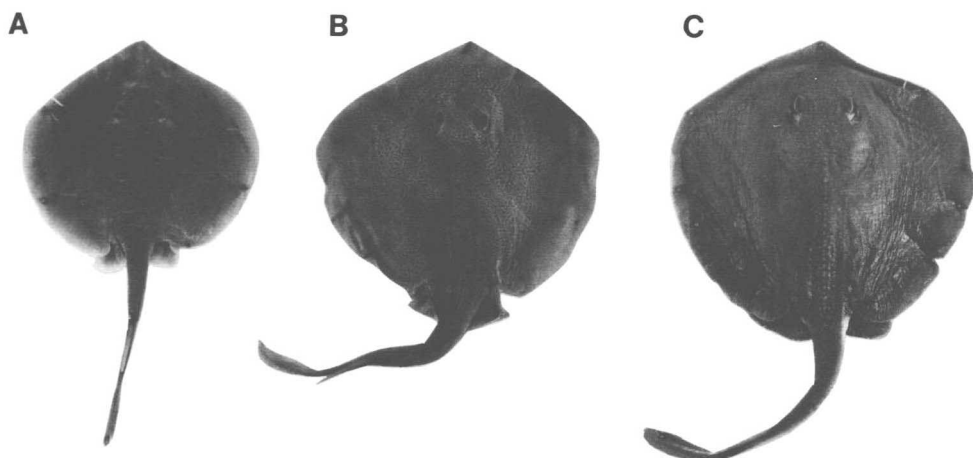


Figure 1. Holotypes of (A) *Urotrygon nana* (FMNH 97107, male, 148 mm TL), (B) *U. reticulata* (USNM 222644, male, 241 mm TL) and (C) *U. simulatrix* (USNM 285187, female, 264 mm TL).

treme margin of disc, sparsely covering mid-portion of disc and tail. Enlarged denticles or thorns absent on midline of disc and tail. Maximum known size about 245 to 250 mm TL.

**Description.**—Proportional dimensions of the one embryo paratype (67 mm TL, SIO 65-167) are not included. Disc almost round in shape, width 1.1 times length (holotype) (1.08 to 1.26 in paratypes); tip of snout to maximum width 48.60% of disc width (38.57–52.49%); antero-lateral margin of disc straight to slightly convex; occasionally slightly concave in males; angle of snout 115 (110°–130° in male paratypes and 120°–133° in female paratypes); tip of snout not forming a projection. Pelvic fins forming equilateral to right-angled triangles, lateral margin broadly rounded; width of pelvic fins 1.21 times length (1.02–2.09). Tail slender and flattened dorsally but slightly convex ventrally, height at axil of pelvic fins 5.96% (6.54–9.94%) of distance from cloaca to tip of caudal fin; tail rarely with lateral keels; distance from cloaca to origin of tail spine 43.09% (31.18–47.00%) of distance from cloaca to tip of caudal fin. Caudal fin moderately slender with dorsal lobe shorter than ventral lobe; tip of caudal fin abruptly rounded; distance from cloaca to origin of dorsal lobe of caudal fin 36.96% of total length (32.40–41.26%); height of caudal fin 22.08% (17.89–38.89%) of length of dorsal lobe of caudal fin.

Preorbital length 4.63 times (3.84–7.00) orbit diameter; preoral length 2.31 times (2.10–3.18) distance between nostrils; interorbital width 1.55 times (1.34–2.45) orbit diameter. Length of spiracles 0.74 times (0.50–0.77) interorbital width. Nasal curtain with fringed and usually deeply concave posterior margin and concave lateral margin, length 52.53% of width (29.25–65.93%). Lobe-like expansion of posterior margin of nostrils weakly developed medially and accommodating expansion of nasal curtain; a cluster of several papillae on proximal edge of lobe-like expansion. Teeth on both jaws, arranged in quincunx, with sharply pointed cusps in males (cusp development begins in males of 100 to 130 mm TL); 31 (29–36) rows of teeth on upper jaw.

Distance between first gill slits 2.43 times (2.19–3.50) distance between nostrils; distance between fifth gill slits 1.35 times (1.26–2.12) distance between nostrils. Number of vertebral centra 63 (57–67 in five paratypes of SIO 65-167).

Denticles ranging from 0.1 to 0.3 mm in height with slender cone-shaped, curved

crowns and stelliform bases (Fig. 2A). Disc and tail naked in near term embryos and specimens smaller than 80 mm TL. Disc covered with denticles in specimens larger than 90 mm TL: densely developed on snout area and margin of disc to near posterior corner of disc and sparsely developed on interorbital and nuchal areas. Denticles sparsely developed on scapular and visceral areas in several specimens (Fig. 2A). One to two rows of slightly enlarged denticles present along inner and outer edges of spiracles, inner one occasionally extending forward to form a single row of denticles on areas of supra-orbital crest. Dorsal and lateral aspects of tail densely covered with denticles, extending to anterior portion of dorsal lobe of caudal fin. Entire dorsal disc of specimens taken from off Costa Rica uniformly covered with denticles.

After preservation in formalin and storage in alcohol, dorsal surface chocolate brown to light brown. Margin of disc narrowly edged with white. Ventral surface white to yellowish white. A short and brownish band extending longitudinally from axil of pelvic fin on midline of ventral surface of tail. Rarely with light brown, irregular-shaped markings on posterior corner of ventral surface of pelvic fin.

*Distribution.*—Along the coasts of northern Nayarit, Golfo de Tehuantepec and Chiapas in Mexico, Champerico in Guatemala and Golfo de Nicoya in Costa Rica (Fig. 3).

*Etymology.*—The specific name *nana* from the Latin adjective in reference to the small adult size of the species.

*Remarks.*—*Urotrygon nana* is distinguished from all other species of *Urotrygon* in having smaller eyes and having a smaller size at maturity. Although this species morphometrically resembles *Urotrygon munda* and *U. sp. (2)* of Miyake and McEachran (1986) (described as *U. reticulata* below), it differs from *U. munda* in having a narrower disc width, shorter dorsal lobe of caudal fin and smaller denticles without enlarged ones on midline of dorsal surface. *Urotrygon nana* differs from *U. reticulata* in having a light brownish dorsal surface. Castro Aguirre (1965) referred to this species as *Urotrygon nebulosus* (sic) (Garman) from Mexico. However, his description and figure clearly indicated that his specimen represented *Urotrygon nana*. He may have confused his specimen with *Urolophus nebulosus* Garman which was synonymized with *Urolophus halleri*. Most specimens of *Urotrygon nana* examined in this study have previously been incorrectly identified with *Urotrygon binghami* Breder. The examination of the type of the latter species confirmed that it represents *Urotrygon rogersi* (Jordan and Starks) (Miyake and McEachran, 1986).

***Urotrygon reticulata* new species**  
Figures 1B and 2B, Table 1

*Urotrygon* sp. (2); Miyake and McEachran, 1986: 291–302.

*Holotype.*—USNM 222644, female, 241 mm TL, Bahia Santelmo, Gulf of Panama, Panama, 8 June 1967.

*Paratypes.*—USNM 285184, 2 males, 87 and 188 mm TL, Bahia Santelmo, Gulf of Panama, Panama, 8 June 1967.

*Diagnosis.*—Entire dorsal body with fine tan to brownish vermiculations. Pattern more diffuse, consisting of speck-like markings, on extreme margin of disc, pelvic fins and dorsal lobe of caudal fin.

*Description.*—Proportional dimensions of the embryo paratype (87 mm TL) are

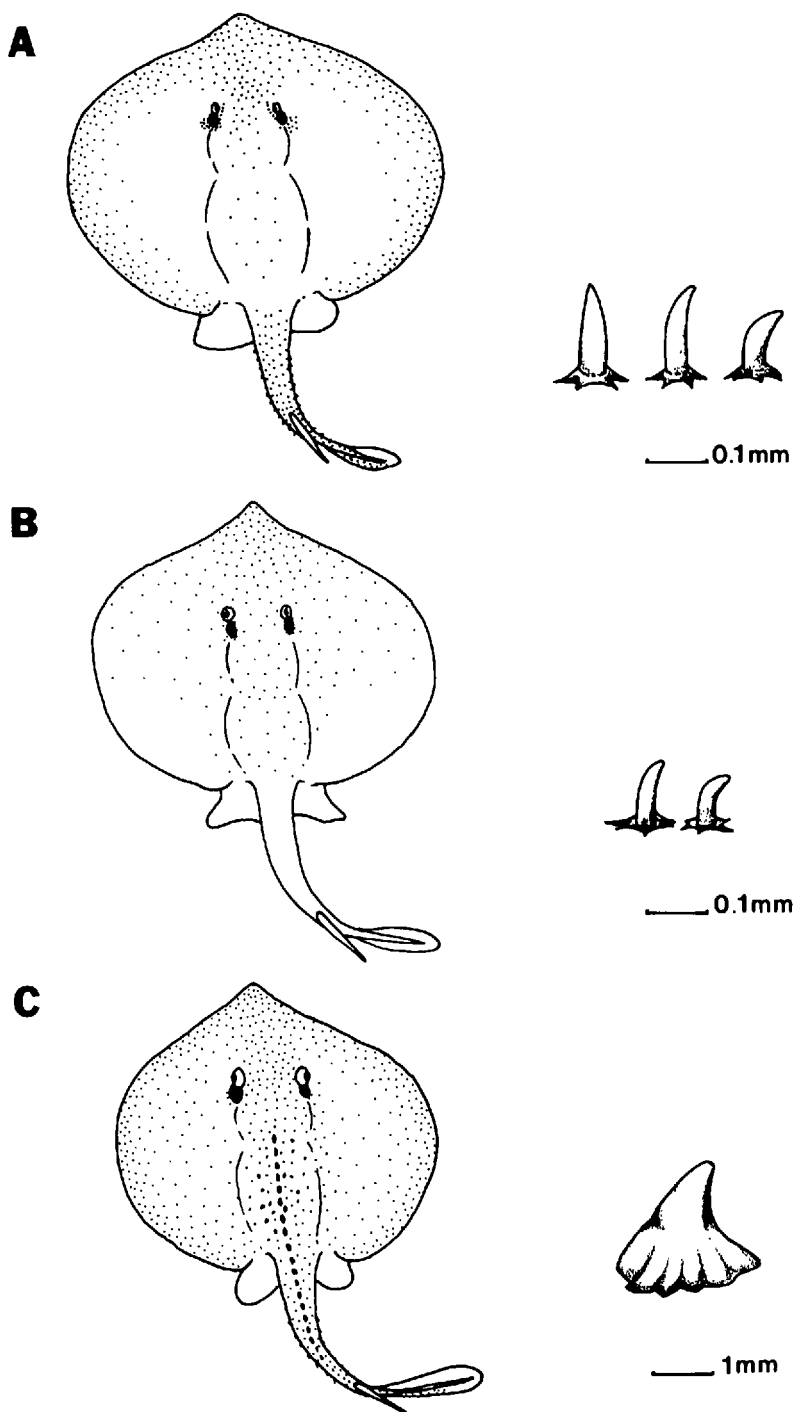


Figure 2. Squamation and denticles of (A) *Urotrygon nana* and (B) *U. reticulata* and squamation and thorn-like denticles of (C) *U. simulatrix*. Only adult squamation is shown.

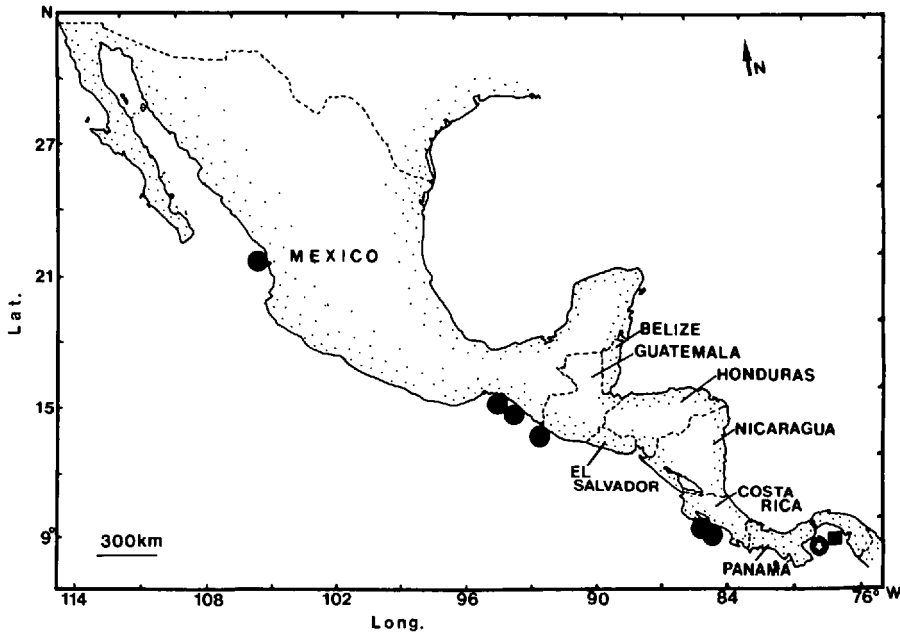


Figure 3. Distributions of *Urotrygon nana* (●), *U. reticulata* (■) and *U. simulatrix* (◐).

not included. Disc almost oval in shape, width 1.06 times length (holotype) (1.05 in adult paratype); tip of snout to maximum width 40.43% of disc width (49.01%); margin of disc straight to slightly convex to level of eyes and abruptly rounded to axil of pectoral fin; angle of snout  $122^\circ$  ( $120^\circ$ ); tip of snout not forming a projection. Pelvic fins forming equilateral triangles, lateral margin nearly straight or slightly convex; width of pelvic fins 1.12 times length (1.24). Tail moderately slender, height at axil of pelvic fins 6.81% (7.42%) of distance from cloaca to tip of caudal fin; tail with weakly developed lateral keels extending from near level of tip of pelvic fins to insertion of tail spine; distance from cloaca to origin of tail spine 50.65% (53.66%) of distance from cloaca to tip of caudal fin. Caudal fin robust and of equal height over most of length; tip of caudal fin broadly rounded; distance from cloaca to origin of dorsal lobe of caudal fin 36.68% of total length (39.63%); height of caudal fin 26.49% (35.33%) of dorsal lobe of caudal fin.

Preorbital length 3.65 times orbit diameter (4.10); preoral length 3.08 times (2.99) distance between nostrils; interorbital width 1.27 times orbit diameter (1.39); eyes moderately large and oriented nearly dorsally, diameter 4.31% (4.48%) of distance from snout to cloaca. Length of spiracles 0.64 times (0.65) interorbital width. Nasal curtain moderately long, posterior margin straight or slightly convex and fringed; length of nasal curtain 53.55% of width (55.78%). Lobe-like expansion of nostrils weakly developed medially and accommodating distal expansion of nasal curtain; one or two papillae on proximal edge of lobe-like expansion. Teeth on both jaws, arranged in quincunx, with cusps in male adult; 38 (34 in embryo paratype and 38 in adult paratype) rows of teeth on upper jaw.

Denticles 0.1 to 0.2 mm in height with slender cone-shaped, curved crowns and small stelliform bases (Fig. 2B). Disc, pelvic fins and tail naked in near term embryo. Denticles in adults densely distributed on snout, areas in front of eyes and margin of disc from snout to level of eyes, but sparsely covering interorbital,

Table 1. Proportional measurements of *Urotrygon nana*, *U. reticulata*, and *U. simulatrix* (proportions are expressed as hundreds of total length)

	<i>Urotrygon nana</i>			<i>Urotrygon reticulata</i>		<i>Urotrygon simulatrix</i>		
	Holotype	Paratypes		Holotype	Paratype	Holotype	Paratypes	
	FMNH 97107	FMNH 97108 (N = 5)	SIO 65-167 (N = 40)*	USNM 222644	USNM 285184 (N = 1)*	USNM 285187	GCRL 13064 (N = 2)*	
Total length (mm)	148	113-169	82-169	241	188	264	267	258
Disc width	58.11	55.59-63.00 ( $\bar{x}$ = 57.63)	56.70-67.90 ( $\bar{x}$ = 61.71)	53.94	56.65	54.17	51.03	51.94
Disc length	52.03	49.49-55.31 ( $\bar{x}$ = 51.27)	49.79-59.15 ( $\bar{x}$ = 53.79)	50.71	53.72	47.08	48.63	51.24
Snout length (preorbital)	28.24	23.03-29.35 ( $\bar{x}$ = 25.18)	24.90-30.54 ( $\bar{x}$ = 27.89)	20.50	26.33	24.02	23.26	23.33
Snout length (preoral)	15.34	12.91-16.55 ( $\bar{x}$ = 14.59)	14.07-17.32 ( $\bar{x}$ = 15.61)	13.98	15.48	11.01	11.44	12.95
Snout to maximum width	14.19	13.08-15.75 ( $\bar{x}$ = 14.10)	13.83-17.11 ( $\bar{x}$ = 15.54)	13.90	16.06	11.67	12.20	11.40
Prenasal length	11.76	10.28-12.30 ( $\bar{x}$ = 11.23)	11.15-13.73 ( $\bar{x}$ = 12.28)	11.45	12.61	8.41	9.42	8.02
Nasal curtain, length	3.51	1.75-2.83 ( $\bar{x}$ = 2.28)	2.48-3.99 ( $\bar{x}$ = 3.40)	2.49	3.14	2.84	3.38	3.18
Nasal curtain, width	6.69	4.50-6.27 ( $\bar{x}$ = 5.35)	4.94-7.70 ( $\bar{x}$ = 6.46)	4.65	5.43	5.19	6.08	6.28
Orbit diameter	3.31	2.38-3.54 ( $\bar{x}$ = 3.00)	2.23-3.46 ( $\bar{x}$ = 2.87)	3.82	3.78	3.41	3.04	3.41
Eye diameter	1.49	1.14-1.50 ( $\bar{x}$ = 1.31)	1.00-1.89 ( $\bar{x}$ = 1.41)	2.12	2.29	2.05	2.10	2.25
Interorbital width	5.14	4.90-5.75 ( $\bar{x}$ = 5.18)	5.13-6.67 ( $\bar{x}$ = 5.84)	4.85	5.27	5.49	5.48	5.81
Orbit to spiracle length	5.74	5.11-5.92 ( $\bar{x}$ = 5.64)	3.85-6.42 ( $\bar{x}$ = 5.20)	5.06	5.37	5.76	5.70	5.85
Spiracle length	3.78	3.71-4.25 ( $\bar{x}$ = 3.77)	2.92-4.46 ( $\bar{x}$ = 3.55)	3.12	3.40	3.98	4.20	4.26
Distance between spiracles	7.91	7.44-8.22 ( $\bar{x}$ = 7.22)	7.20-9.63 ( $\bar{x}$ = 7.96)	7.30	7.71	7.39	7.84	8.33
Mouth width	5.27	4.76-6.15 ( $\bar{x}$ = 5.42)	5.42-6.71 ( $\bar{x}$ = 6.07)	5.23	5.43	5.19	5.18	5.23
Distance between nostrils	6.15	4.56-6.27 ( $\bar{x}$ = 5.16)	5.00-7.01 ( $\bar{x}$ = 5.92)	4.52	5.37	4.77	5.78	5.16
Pelvic fin, length	10.54	7.34-9.38 ( $\bar{x}$ = 9.32)	10.12-14.08 ( $\bar{x}$ = 11.43)	10.75	11.97	12.39	11.03	12.05
Pelvic fin, width	12.70	14.94-15.75 ( $\bar{x}$ = 15.30)	11.45-18.23 ( $\bar{x}$ = 14.35)	11.99	14.89	13.64	12.46	13.08
Caudal fin, length	3.58	2.94-3.67 ( $\bar{x}$ = 3.35)	3.53-4.94 ( $\bar{x}$ = 4.11)	3.78	3.72	4.05	3.60	4.34
Caudal fin, height	16.22	12.44-19.93 ( $\bar{x}$ = 15.45)	12.68-17.50 ( $\bar{x}$ = 15.29)	14.27	10.53	18.75	19.36	17.79
Tail height at axil of pelvic fins	3.18	3.50-3.81 ( $\bar{x}$ = 3.64)	3.25-5.03 ( $\bar{x}$ = 4.16)	3.44	3.67	3.56	4.13	4.46
Width of first gill opening	2.03	1.63-2.10 ( $\bar{x}$ = 1.88)	1.44-2.55 ( $\bar{x}$ = 1.95)	1.49	1.81	2.23	1.95	2.02
Width of third gill opening	1.96	1.77-2.19 ( $\bar{x}$ = 1.95)	1.57-2.75 ( $\bar{x}$ = 2.06)	1.74	2.01	2.31	2.06	2.13
Width of fifth gill opening	1.35	0.95-1.40 ( $\bar{x}$ = 1.21)	0.78-1.62 ( $\bar{x}$ = 1.27)	1.12	0.96	1.14	1.01	1.09
Distance between first gill openings	14.93	14.56-16.08 ( $\bar{x}$ = 15.47)	13.94-18.15 ( $\bar{x}$ = 15.28)	14.07	15.05	13.64	12.95	13.53
Distance between fifth gill openings	8.31	8.11-9.69 ( $\bar{x}$ = 9.08)	7.78-10.74 ( $\bar{x}$ = 9.05)	7.88	8.30	7.95	7.62	8.14
Distance—snout to cloaca	46.08	45.57-48.32 ( $\bar{x}$ = 46.98)	47.63-54.07 ( $\bar{x}$ = 50.02)	49.17	51.12	47.50	44.02	48.60
Distance—cloaca to tail spine	22.97	22.80-23.08 ( $\bar{x}$ = 22.15)	18.24-28.32 ( $\bar{x}$ = 21.18)	25.60	26.54	26.36	25.57	25.19
Distance—cloaca to caudal fin origin	36.96	35.00-41.26 ( $\bar{x}$ = 37.88)	32.26-37.78 ( $\bar{x}$ = 35.24)	36.68	39.63	35.23	36.47	33.64
Distance—cloaca to tip of caudal fin	53.31	49.57-52.29 ( $\bar{x}$ = 51.29)	46.64-52.67 ( $\bar{x}$ = 50.11)	50.54	49.46	53.11	55.46	51.09

\* Paratypes of embryos are not included.

nuchal, scapular regions and mid-portion of visceral cavity (Fig. 2B). Two or three rows of denticles present around inner and outer margins of spiracles. Ventral sides of disc and both sides of pelvic fins and tail entirely naked.

After preservation in formalin and storage in alcohol, entire dorsal surface covered with fine brownish vermiculations (Fig. 1B). Pattern more diffuse, consisting of speck-like markings, on extreme margin of disc, pelvic fins and dorsal lobe of caudal fin. Vermiculation pattern in the embryo paratype more coarse on disc and tail. Ventral surface of body white.

*Distribution.*—Bahia Santelmo, Gulf of Panama (Fig. 3).

*Etymology.*—The specific name *reticulata* from the Latin adjective in reference to color pattern on dorsal body of the species.

*Remarks.*—The vermiculations on dorsal surface are unique to this species and distinguish it from all other species of *Urotrygon*.

***Urotrygon simulatrix* new species**

Figures 1C and 2C, Table 1

*Urotrygon* sp. (3); Miyake and McEachran, 1986: 291–302.

*Holotype.*—USNM 285187, female 264 mm TL, Punta Paitilla, Panama, 8 Mar. 1974, collected by C. E. Dawson et al.

*Paratypes.*—GCRL 13064, 2 males, 93 and 267 mm TL, 1 female, 258 mm TL, Punta Paitilla, Panama, 8 Mar. 1974, collected by C. E. Dawson et al.

*Diagnosis.*—Entire dorsal disc and tail covered with high stout cone-shaped and slightly recurved denticles. Denticles enlarged toward midline and forming one or two continuous rows on midline of disc and tail from nuchal to origin of tail spine. Dorsal surface of disc and tail uniformly dark grayish brown, relatively broadly edged with yellowish white.

*Description.*—Proportional dimensions of the embryo paratype (93 mm TL) are not included. Disc round to diamond shaped, width 1.15 times length (1.05 and 1.01 in male and female paratypes, respectively); tip of snout to maximum width 44.34% of disc width (45.54 and 51.01%); antero-lateral margin of disc convex in both sexes and slightly expanded laterally to level of spiracles, abruptly rounded to axil of pectoral fin; angle of snout 135° (117° and 131°); tip of snout not forming a projection. Pelvic fins forming equilateral triangles, lateral margin straight or only slightly convex and posterior margin broadly rounded; corner of pelvic fins broadly rounded; width of pelvic fins 1.10 times length (1.13 and 1.14). Tail moderately slender, depressed dorsally but rather convex ventrally, height at axil of pelvic fins 6.92% (7.44 and 8.73%) of distance from cloaca to tip of caudal fin; tail with well developed lateral keels extending on sides from behind insertion of pelvic fins to insertion of tail spine; distance from cloaca to origin of tail spine 49.64% (47.90 and 49.32%) of distance from cloaca to tip of caudal fin. Caudal fin moderately long, broader distally; tip of caudal fin broadly rounded; distance from cloaca to origin of dorsal lobe of caudal fin 35.23% of total length (36.47 and 33.64%); height of caudal fin 21.62% (18.60 and 24.04%) of length of dorsal lobe of caudal fin.

Preorbital length 3.26 times orbit diameter (3.77 and 3.80); preoral length 2.44 times (2.11 and 2.21) distance between nostrils; interorbital width 1.61 times (1.80 and 1.70) orbit diameter; eyes moderately large and oriented dorso-laterally, diameter 4.31% (4.77 and 4.63%) of distance from snout to cloaca. Length of spiracles 0.72 times interorbital width (0.77 and 0.73). Nasal curtain relatively

long, posterior margin deeply concave and fringed; length of nasal curtain 54.74% of width (55.65 and 50.62%). Lobe-like expansion of nostrils well developed medially and accommodating distal expansion of nasal curtain; several papillae on proximal edge of lobe-like expansion. Teeth on both jaws, arranged in quin-cunx, with sharp cusps in male; 33 (35 embryo paratype and 35 and 29 in adult paratypes).

Distance between first gill slits 2.86 times (2.24 and 2.62) distance between nostrils; distance between fifth gill slits 1.67 times (1.32 and 1.58) distance between nostrils. Number of vertebral centra 86 (88 and 83).

Denticles and thorns similar in shape, 0.5 to 2.0 mm in height with tall cone-shaped crowns. Basal plates forming tall bases with shallow depression around it (Fig. 2C). Curvature of crowns increasing with size. Disc and tail naked in near term embryo. Denticles in adults dense on entire dorsal disc and tail; densest on snout, interorbital, mid-portion of disc from nuchal to level of axil of pelvic fins, over visceral cavity and dorsal aspect of tail. Denticles grade into thorns toward midline where they form a continuous series from nuchal to origin of tail spine. Anterior portion of dorsal lobe of caudal fin densely covered with denticles. Pelvic fins and ventral surface of body devoid of denticles.

After preservation in formalin and storage in alcohol, dorsal disc, pelvic fins and tail uniformly dark grayish brown, narrowly edged with yellowish white. Ventral surface uniformly yellowish white, with broad brownish margin along edge of disc and pelvic fins. A brownish stripe extending longitudinally on ventral surface of tail between level of posterior tip of pelvic fins and origin of tail spine.

*Distribution.*—Punta Paitilla, Bay of Panama (Fig. 3).

*Etymology.*—The specific name *simulatrix*, a feminine appositional noun, in reference to the fact that the species resembles *Urotrygon munda* in squamation and *U. chilensis* in morphometric characters.

*Remarks.*—This species resembles *Urotrygon munda* and *U. chilensis*. However, the squamation and shape of denticles and thorns clearly distinguish it from *U. chilensis* Günther. *Urotrygon chilensis* was incorrectly synonymized with *U. asterias* in Miyake and McEachran (1986). *Urotrygon munda* Gill differs from *U. simulatrix* in possessing lower number of vertebral centra, more dorso-ventrally compressed tail and shorter dorsal lobe of caudal fin (Miyake and McEachran, 1986).

#### KEY TO THE SPECIES OF *UROTRYGON*

Although the key given below includes *Urotrygon daviesi* Wallace, our own comparisons of internal morphology of batoid fishes and Compagno's observation (pers. comm.) on the morphology of this species suggest that *U. daviesi* should be removed from the genus *Urotrygon*.

- 1a Velvet-like denticles present on dorsal disc and both dorsal and ventral surface of tail. Long snout; preorbital length 16.61 to 19.86% of total length. .... *U. daviesi* Wallace, 1967.
- 1b Denticles absent on ventral surface of tail. Relatively short snout; preorbital length 12.37 to 18.47% ( $\bar{x}$  = 12.57%) of total length. .... 2.
- 2a Brownish vermiculation pattern on entire dorsal disc. .... *U. reticulata* new species.
- 2b Dorsal aspect of disc generally uniformly brownish to tan; dark brownish markings present in some individuals of two species (*U. chilensis* and *U. rogersi*). .... 3.
- 3a Short and robust caudal fin; length of dorsal lobe of caudal fin 9.49 to 17.61% ( $\bar{x}$  = 12.99%) of total length. Small but strong recurved denticles covering entire dorsal disc and tail. .... *U. munda* Gill, 1863.
- 3b Slender caudal fin with or without tapered tip; length of dorsal lobe of caudal fin 12.44 to 23.53% ( $\bar{x}$  = 16.62%) of total length. Denticles small and not strongly recurved, except for those of *U. simulatrix*. .... 4.



- 4a Eyes small; eye diameter 1.57 to 3.76% ( $\bar{x}$  = 2.54%) of length of snout to center of cloaca. Thorns absent on dorsal disc and tail. .... 5.
- 4b Eyes relatively large; eye diameter 2.66 to 6.58% ( $\bar{x}$  = 4.49%) of length of snout to center of cloaca. Thorns or enlarged denticles present on midline of dorsal disc and/or tail. .... 6.
- 5a Narrow disc width; disc width 44.23 to 56.34% ( $\bar{x}$  = 48.17%) of total length. Slender and tapered caudal fin; length of dorsal lobe of caudal fin 15.07 to 23.53% ( $\bar{x}$  = 19.24%) of total length. .... *U. microphthalmum* Delsman, 1941.
- 5b Relatively wide disc; disc width 54.70 to 67.90% ( $\bar{x}$  = 60.90%) of total length. Caudal fin slender but not tapered; length of dorsal lobe of caudal fin 12.44 to 19.93% ( $\bar{x}$  = 15.28%) of total length. .... *U. nana* new species.
- 6a Orbit diameter 2.39 to 2.73% ( $\bar{x}$  = 2.56%) of total length. Angle of snout 138° to 148° ( $\bar{x}$  = 144°) in females. Small denticles uniformly present on dorsal disc, except narrow naked area along margin. .... *U. venezuelae* Schultz, 1949.
- 6b Orbit diameter 2.52 to 4.74% ( $\bar{x}$  = 3.59%) of total length. Angle of snout 113° to 140° ( $\bar{x}$  = 130°) in females. Denticles present on entire dorsal disc, sparsely or densely. .... 7.
- 7a Thorns present only on midline of dorsal tail. Eye diameter 2.66 to 4.47% ( $\bar{x}$  = 3.50%) of length of snout to center of cloaca. Preorbital length 11.76 to 15.61% ( $\bar{x}$  = 13.92%) of total length. Tail height 2.45 to 3.57% ( $\bar{x}$  = 3.00%) of total length. .... *U. aspidura* (Jordan and Gilbert, 1881).
- 7b Thorns present on midline of both dorsal disc and tail, in a continuous or discontinuous row. Eye diameter 3.13 to 6.18% ( $\bar{x}$  = 4.61%) of length of snout to center of cloaca. Preorbital length 9.82 to 13.59% ( $\bar{x}$  = 11.90%) of total length. Tail height 3.03 to 4.97% ( $\bar{x}$  = 4.09%) of total length. .... 8.
- 8a Small denticles arranged in several parallel rows on midline region of visceral cavity; each pectoral radial in marginal area of disc from level of eyes to posterior corner of pectoral fin bearing small denticles. Tail height 2.49 to 4.00% ( $\bar{x}$  = 3.00%) of total length. .... *U. rogersi* (Jordan and Starks, 1895).
- 8b Denticles sparsely or densely distributed without any special arrangements on disc. Tail height 3.03 to 4.97% ( $\bar{x}$  = 4.11%) of total length. .... 9.
- 9a Different shape of thorns from that of denticles. Thorns with oval basal plate on midline of dorsal disc and tail, arranged in a continuous or discontinuous row; in some individuals, thorns present only on nuchal to scapular region. .... *U. chilensis* (Günther, 1871).
- 9b Both denticles and thorns similar in shape; high cone-shaped and recurved with stelliform basal. Thorns arranged on midline of dorsal disc and tail continuously. .... *U. simulatrix* new species.

### ACKNOWLEDGMENTS

We are greatly indebted to the following individuals for the loan of specimens: T. Iwamoto and M. E. Anderson (CAS); R. K. Johnson (FMNH) (currently Grice Marine Biological Laboratory, Charleston), D. J. Stewart (FMNH) (currently Center for Limnology, University of Wisconsin, Madison) and T. Grande (FMNH); C. E. Dawson and S. G. Poss (GCRL); R. I. Lavenberg, C. C. Swift and J. A. Seigel (LACM); R. Rosenblatt and H. J. Walker, Jr. (SIO); V. G. Springer, S. L. Jewett and L. P. Norrod (USNM). We are grateful to B. Chernoff of Academy of Natural Sciences, Philadelphia for his assistance in locating the type of *Urotrygon*. We acknowledge J. D. Dixon of Texas A&M University (TAMU) and two reviewers for their assistance in nomenclatorial problems. Thanks also go to M. Retzer, assistant curator of Texas Cooperative Wildlife Collection, Texas A&M University, for his curatorial assistance. S. L. Jewett and L. P. Norrod are especially acknowledged for information on the type of *Urotrygon*. This study was supported in part by the National Science Foundation (DEB-82-04661) to J.D.M. and by the Mini-grant of College of Agriculture, Texas A&M University and Ernst Mayr Grant of Museum of Comparative Zoology, Harvard University to T.M.

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DATE ACCEPTED: June 26, 1987.

ADDRESS: *Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843.*